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No. 1

Machinability Influenced by Many Factors

C. W. Horack Opens Golden Gate Symposium of Three Papers and Discussion on Machining

By C. W. Horack

Golden Gate Chapter—The November meeting was devoted to a "Symposium on the Machinability of Metals," and drew an attendance of about 300.

Owing to the scope of the subject and the limited time allowed, Program Chairman Drake opened the technical session without much formality.

The first talk was presented by Carl W. Horack, associate in mechanical engineering at the University of California. His subject was "Factors Influencing Machinability of Steels."

Mr. Horack stated that machinability could not be expressed by a single term or coefficient, but must be defined with certain limiting conditions in mind. That is, one may base machinability upon (1) the maximum cutting speed that can be maintained for a given tool life, (2) the ability to cut with low cutting pressure, which lowers the forces on the tool and machine, keeps power consumption at a minimum and allows heavier cuts without undue distortion of the work, or (3) the ability to produce and maintain the required surface finish and at the same time maintain size within the allowable tolerances.

It is apparent that certain factors which affect one set of conditions more or less affect the others also.

In discussing machinability, it seems desirable to classify materials into groups, as steels, irons, non-ferrous, and non-metals such as bakelite and rawhide.

Machinability will also depend on the method of machining—whether it is turning, drilling, milling, broaching,

(Continued on page 2)



Compliments

To W. A. Olson on his appointment as manager of the Cleveland office of Bridgeport Brass Co. Bill has been transferred to Cleveland from the Rochester Chapter, where he was chairman of the Entertainment Committee.

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To International Harvester Co. on obtaining the services of Harry J. Kicherer, vice-chairman, North West Chapter, A.S.M., on the manufacturing staff of the Tractor Works, Chicago.

**

To Francis C. Frary, director of research, Aluminum Research Laboratories, Aluminum Co. of America, on receiving the Pittsburgh Award for 1937 from the Pittsburgh Section of the American Chemical Society.

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To Rustless Iron and Steel Corp. on the appointment of F. J. Elliott, formerly with E. F. Houghton & Co., as Cleveland district sales manager.

To Present Papers



R. L. Wilson



H. W. McQuaid



L. F. Scherer



F. L. LaQue

These Men Are Among the 40 or More Who Will Present Papers at the A.S.M. Technical Sessions of the Western Metal Congress Meeting in Los Angeles the Week of March 21 to 25, 1938

Columbus Plans Heat Treat Course in Simple Terms

The Columbus Chapter will conduct a series of six weekly lectures on the "Fundamentals and Principles of Heat Treatment" starting Jan. 17 at Ohio State University.

The talks will be made in simple terms, with technical verbiage explained so as to be of particular interest to shop men. The prime object of the course is to foster the ability to understand and benefit from current magazines and other literature pertaining to hardening and heat treating steel.

The course is based on the book by Dr. M. A. Grossmann, director of research, Carnegie-Illinois Steel Corp., and the lectures will be presented by local metallurgists. The final meeting will be devoted to a round table discussion of commercial heat treating operations.

Authors Start Work on Papers For Western Metal Congress; Other Societies Plan Programs

Wilson, McQuaid, Scherer on Petroleum Program; Papers for Other Sessions Announced

One of the most important technical meetings to be held during the Western Metal Congress in Los Angeles, March 21 to 25, will be the session on petroleum. This will be an all-day meeting, with nine papers covering metals used for the production and transportation of petroleum and for oil refining.

Well-known names featured on this program will include Ralph L. Wilson, metallurgical engineer, Climax Molybdenum Corp., Canton, Ohio, and A.S.M. trustee; and H. W. McQuaid, metallurgist, Republic Steel Corp., Cleveland, 1935 A.S.M. Campbell Memorial Lecturer and co-originator of the famed McQuaid-Ehn test.

Mr. Wilson will have two papers, one on "The High Temperature Strength of Steels" and another on "Alloy Steels for Tubular Oil Heaters." Mr. McQuaid's paper will cover well casings, drills, sucker rods, and hard facings.

L. F. Scherer, assistant chief engineer, Texas Pipe Line Co., Houston, will discuss "Metals Used In Pipe Line Construction." Mr. Scherer's paper, which will also cover metals used in diesel engines, pump parts, and other services peculiar to pipe line stations, will be more of an informative than technical nature and should be of especial interest to the practical man.

Mr. Scherer is a mechanical engineering graduate of University of Illinois and has been with Texas Pipe Line Co. since 1928, where he has been actively interested in the company's crude oil transportation system which forms a vast network of 8400 miles of line.

On Chemical Session

Another extensive program of particular interest to the West Coast will be that devoted to the chemical industry.

F. L. LaQue, who will have a general paper on the "Application of Metals in the Chemical Industry," has

(Continued on page 5)

H. W. Zieler Waxes Serious but Never Dull On Illumination for Metal Microscopes

By J. S. Marsh

New York Chapter, Dec. 13—Still chuckling over the newspaper-day reminiscences of F. G. Hartwick (the puzzle expert behind the Old Gold contest), the audience settled down to its serious business.

Those who have heard H. W. Zieler, president of E. Leitz, Inc., know that although he can be serious, he is incapable of being dull, and this was amply proved again by his discussion of the various systems of illumination for metal microscopes.

By way of establishing a basis of comparison, Mr. Zieler discussed vertical illumination at some length. This was followed by the various forms of oblique lighting, including dark field. Difference of appearance of the field was shown spectacularly by photomi-

cographs of a single specimen under several conditions of lighting.

Last to be discussed was the relatively recent application of polarized light to metal microscopy.

High spots in the discussion, led by J. R. Vilella in his customary capable fashion, were some beautiful natural-color micros of sections of patina shown by E. P. Polushkin. These were made by reflecting diffused light to the specimen by means of a concave mirror.

Other members reported promising results from dark field illumination by polarized light.

The next step is evidently up to the metallographers, for plenty of optical equipment is available. That they are accepting the challenge was indicated by the fact that informal discussion threatened to go on indefinitely.

A. W. S. Pacific Coast Sections and A. S. M. E. to Meet in Conjunction With Congress

The Pacific Coast Sections of the American Welding Society, working in conjunction with the American Society for Metals, will provide an imposing list of western experts on practical welding applications during the Western Metal Congress and Exposition in Los Angeles the week of March 21 to 25.

The A.W.S. meetings will be held at the Biltmore Hotel, which will also be the headquarters for the American Society of Mechanical Engineers' spring meeting March 23, 24 and 25, and for the A.S.M., sponsor of the Congress.

Speakers on the Welding Society program will be heads of various projects and construction jobs who can talk from a practical viewpoint. Most of these men have had outstanding engineering accomplishments in the western states.

A few of the subjects proposed for discussion are:

Welded Piping for High Temperature and High Pressure Service.

Design and Welded Connections in Building Construction.

Welded Oil Well Casings.

Fabrication of Large Pipe for Water and Power Transmission.

Stainless Welding.

Fabrication for Machine Design.

Early plans include the attendance of A.W.S. President T. V. Lang and

(Continued on page 2)

Milwaukee Finishes Course of Five Lectures on X-Rays

By George K. Dreher

On December 13 the Milwaukee Chapter completed a course in "X-rays in Theory and Practice," for which E. W. Page, manager of the Industrial Division of the General Electric X-Ray Corp., delivered two lectures, and D. H. Reynolds, diffraction specialist for General Electric X-Ray Corp., delivered the last three lectures.

An average of 125 members attended weekly sessions. Many favorable comments were expressed on the subjects offered.

Instead of offering a spring course, the Milwaukee Chapter intends to conduct several plant visitations under the direction of E. O. Dixon, past chairman of the Chapter, during which several of the less familiar metallurgical operations are to be viewed.

Beg Pardon, Yale!

By an unfortunate printer's error Yale University was omitted from the list of schools having accredited courses in metallurgical engineering published in last month's REVIEW, page 11. Yale does, of course, offer a metallurgical engineering course approved by the Engineers' Council for Professional Development.

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RAY T. BAYLESS.....Editor
M. R. HYSLOP.....Managing Editor

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Western Program Plans Announced By A. W. S., A. S. M. E.

(Continued from page 1)

Divisional Vice-President K. V. King.

During the Congress the Pacific Coast will probably see the largest assembly of metal and welding experts ever held in a western states area. This is an exceptional opportunity to get first-hand information on the latest procedures and also to contact prominent men in the welding and metal industry.

The tentative program for the spring meeting of the American Society of Mechanical Engineers, to be held in Los Angeles March 23, 24, and 25, has been announced by Prof. R. L. Daugherty, program chairman.

This national meeting of the A.S.M.E. will have headquarters in the Hotel Biltmore, Los Angeles, during the same week as the Western Metal Congress.

The fields of interest to be covered by the A.S.M.E. are as follows:

Wednesday, March 23

Applied Mechanics Session
Petroleum Session—four papers

1. Pipelines
2. Progress in deep well pumping
3. Deep well drilling
4. Design of oil furnaces

Thursday, March 24

Hydraulics Session—four papers
Miscellaneous Session—four papers

1. Mechanical problems in the design of the 200-inch telescope
2. Engineering in the motion picture industry
3. Mechanical problems in tractor design
4. Orchard heaters

Friday, March 25

Machine Shop Practice Session—two papers

Aeronautics Session—two papers
Hydraulics Session—four papers

Bates to Lecture on Coast

Dr. A. Allen Bates, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., will present his lecture course on "Fundamentals of Ferrous Metallurgy" in person before the Golden Gate Chapter of the Society next March.

The lectures will be held on five consecutive evenings, starting Monday, March 14, at the Oakland Hotel, Oakland, Calif.

Members of the Society may register for the course free of charge. Cost to non-members will be \$10.00.

Symposium Covers Machining Problems of Steel & Aluminum

(Continued from page 1)

or some other method. Because a material seems quite machinable when turned does not indicate that it can be as readily drilled, tapped or ground.

Each group of materials requires a more or less definitely shaped tool, having a certain range of rake and clearance angles. For instance, a tool that is well adapted for machining aluminum will differ considerably from the general tool shape for steels.

Certain characteristics of the tool must likewise be considered, such as tool material, hardness and toughness, shape and cutting angles.

The cutting action, formation and type of chip were said to be a large factor in the machinability of a metal.

The effect of cutting angle, speed, feed and depth on the type of chip was illustrated by means of curves and diagrams projected upon the screen. Curves showing the effect of speed, varying depth to feed ratios, and variation in tensile strength on the tool life were also shown.

A flow type chip results in least temperature and pressure, gives maximum tool life, and generally promotes good machinability.

The second technical paper was given by Harry C. Gunetti of Merco Nordstrom Valve Co., Oakland, Calif.

Mr. Gunetti based his talk on "Some Interesting Problems in Machining Cast and Forged Steel." This talk was concerned mainly with a practical study of the type of cutting material best adapted for cast steel and forgings.

By means of large scale diagrams, the speaker illustrated some of the machining operations on which tests had been run.

Reaming Cast Steel Valves

After considerable experimentation it was found that reamers used for cutting into the scale of the small cast steel valves stood up better when made of a molybdenum high speed steel. This type of steel was said to be relatively tough, and the tendency to chip is less than with other steels. This steel, however, is more susceptible to high temperatures produced by the cutting action than the tungsten and cobalt high speed steels, and therefore must be flooded with a coolant to carry away the heat.

In operations where no scale is encountered a tungsten-cobalt steel has proved to be very satisfactory.

On finishing operations three types of steel produce good results, depending on the machines used; (a) 18-4-1; (b) 18-4-1 cobalt steel; (c) 14-4-2 cobalt steel.

An 18-4-2 cobalt steel may be used to rough out large bores. This steel has a high red-hardness and yet is tough enough not to chip on interrupted cuts. Stellite "J" and "2400," although possessing higher red-hardness, chip on interrupted cuts, as do also tungsten and tantalum carbides.

On interrupted finishing cuts a 14-4-2 steel with 5% cobalt and 0.50% molybdenum has proved most satisfactory.

In conclusion Mr. Gunetti stated that in deciding on a cutting material, one must take into consideration all of the conditions under which tools must work. Finding the proper tool material often requires a number of trials with different types of steels, but the time spent on experimenting will pay dividends in increased production far in excess of the expense involved.

The third speaker on the program was Howard J. Heath, Pacific Coast Division, Aluminum Co. of America. The subject of Mr. Heath's talk was "Machining of Aluminum Alloys."

The primary consideration in machining aluminum is to produce a satisfactory surface from the standpoint of appearance and smoothness. For these reasons, the machinability of an aluminum alloy is generally judged by the size and bulk of the curly chips and the smoothness of the finished surface, rather than by tool wear or power consumption.

The alloy compositions which ordinarily have relatively high concentrations of alloy, and therefore a discontinuous structure, were said to be more easily machined than other alloys of a more homogeneous structure and plastic nature.

Three classes of aluminum alloys, grouped according to chemical composition and in the order of decreasing machinability, were named as follows: (1) Aluminum-magnesium alloys, (2) aluminum-copper alloys, and (3) aluminum-silicon alloys.

Machining Al-Si Alloys

Mr. Heath stated that the difficulty in machining the aluminum-silicon alloys has been largely overcome by the use of tungsten carbide cutting tools having shapes recommended for aluminum alloys in general.

Attention was called to the recent development of a truly free-cutting aluminum alloy for use in automatic screw machines. This alloy, known as 11S-T, was said to differ but slightly in tensile properties from 17S-T or free-cutting brass. Comparative production data on the 11S-T alloy show an increase of from 100 to 400% in tool life, when measured by the number of parts machined per grind of the tool.

For best results in machining aluminum alloys the tool forms given in the A.S.M. Metals Handbook were recommended. In addition to the correct tool shape, the maintenance of a keen cutting edge at all times was said to be of particular importance.

Owing to the length of time taken by these three talks it was decided to postpone the discussion to some future meeting night.

Domestic Tool Steel Inspection Stringent

By R. J. Haigis

Hartford Chapter—There is a law in Connecticut that no hall shall be crowded beyond its seating capacity, but this law was very definitely broken on Dec. 14, when approximately 200 members and guests crowded into the Hartford Electric Light Co. auditorium to hear Reinhold Schempp, metallurgist, Halcomb division of the Crucible Steel Co. of America, talk on the subject of "Steel Inspection at the Mill."

Mr. Schempp gave an interesting talk, well supplemented with lantern slides, covering the numerous and expensive tests employed by a modern steel mill to assure the high qualities and properties of present-day domestic tool steels.

The talk covered the tests and inspections employed from the moment the order is received and the charge for the heat is selected, until the final inspection when the shipment leaves the mill.

Mr. Schempp was kept busy answering questions long after his formal talk had been concluded, and many men left the meeting with a new conception of what is behind a piece of tool steel and with the conviction that domestic steels today are the equal or even superior to the foreign product.

Gleanings...

. . . from the chapters

Inkling

An inkling of all the interesting things that will be going on in Los Angeles the week of March 21 to 25 can be gained from this issue of THE REVIEW. But the stories on these pages don't even begin to cover a fraction of the many events and well-filled programs that are rapidly being organized . . . Nor all the new ideas and variety of exhibits in store for those who visit the Western Metal Exposition the same week.

Popular

We're willing to wager that one of the most popular and best attended sessions on the Western Congress program will be the one on machinability . . . Why? Because so many of the chapters have conducted symposia on this subject with truly amazing results (see stories on page 1 and page 5). "One of the most thought-provoking and otherwise productive meetings that the Chapter has held," writes Boston Chairman H. H. Lester.

Diversity

The Cincinnati Chapter is one of the busiest chapters in the entire A.S.M. family, having over 50 meetings planned for this season. They include chapter meetings, group discussion, educational courses.

Many of the other chapters, including Chicago, Pittsburgh, Cleveland, likewise conduct three entirely different types of meetings—regular monthly meetings with formal lectures, educational course meetings, and discussion meetings—of either a practical or theoretical nature . . . Everybody to his fancy, said Nancy . . .

Sugar-Coated Learnin'

Right up to the minute is the New Jersey Chapter, with plans to try out the latest thing in educational experiments this spring. This will be a five-series movie program beginning the week of March 6 and ending the week of April 3. Subjects have not yet been announced.

Incidentally, the new national Educational Committee of the Society is reported doing some intense investigation on this same subject of visual education for metallurgists.

Year-End Thought

Now that it's a new year, don't forget that the National Office of the Society will bind all your last year's Transactions into one sturdy cloth volume for only \$2.00. You will find it far more convenient and permanent to keep them in this form.

Baltimore to Have Three Lectures on Fundamentals

The Baltimore Chapter of the Society has announced a series of three educational lectures to be held at the Engineers Club.

The first lecture, on Jan. 18, was on "The Theory of Alloys" by Frank Kouwenhoven of the Mechanical Engineering Department of Johns Hopkins University.

On March 1, John R. Miller of Reid-Avery Co. will talk on "Metal Crystals," and the subject of the final lecture on April 10 will be the "Iron-Carbon Constitution Diagram."

These lectures will cover in as detailed a manner as possible in the time available some of the fundamentals upon which the science of metals is based. The course is planned as a beginning which can be expanded and amplified in future courses of a similar nature.

Rolling of Cast Iron Amazes Chicago Men

Cast Iron Can Be Rolled at Temperatures Well Above the Critical but Below the Solidus Forbes Relates

By David R. Howerton

Chicago Chapter—To an amazed audience at the December monthly meeting, the process of hot rolling cast iron was explained by Duncan P. Forbes, president, Gunite Foundries Corp.



While many foundries continue to produce thousands of tons of the old-fashioned brittle cast iron described in handbooks of metallurgy, there are foundries in increasing numbers equipped with chemical and physical laboratories and manned by capable metallurgists which have broken away from the old traditions and make castings of greater engineering value.

Improved Properties Are Greatest Cast Iron Development

The greatest single development in cast iron has been the improvement in physical properties, resulting in "high test cast iron."

Mr. Forbes discussed the properties of this material and of "pearlitic malleable," and then described the new process of rolling cast iron.

Both gray iron and white iron are relatively non-ductile at ordinary temperatures, but it now appears that at temperatures well above the critical, but below the solidus temperature, white iron billets become relatively plastic and can be rolled into sheets, bars, or structural shapes in the same way as steel billets.

Attempt to Cast Sheets

The idea of rolling "cast iron" was conceived in attempting to cast malleable iron sheets roughly 4 ft. square and $\frac{1}{4}$ or $\frac{3}{8}$ in. in thickness.

Under certain conditions of control it is possible to roll the metal completely to the desired shape as white iron, which subsequently can be heat treated to precipitate temper carbon and to form malleable iron or pearlitic malleable.

Under other conditions, particularly of analysis, it is possible to roll the metal down to shape and at the same time almost complete the formation of temper carbon while the metal is being rolled. It then requires only a short heat treatment to leave the structure of the matrix in the desired form.

The fracture of rolled malleable iron has a striking resemblance to the fibrous fracture of wrought iron, the elongated deposits of graphite acting similarly to the elongated deposits of slag in wrought iron.

The field of usefulness for this material has not been adequately investigated and, therefore, its limits of application are not known. It is believed, however, that the rolled material inherits the corrosion resistance possessed by the cast metal and also many other of the special properties enjoyed by gray iron and malleable iron castings.

Christmas Treat Is Film Of Summer Golfing Party

By G. R. Fitterer

Pittsburgh Chapter members turned out in great numbers for relaxation and fellowship at the annual Christmas party Dec. 9.

The Entertainment Committee, with its long-standing reputation for giving the members a real treat, had an unusual feature in the form of a movie that was taken of the members and their friends at the summer party of the Chapter. A synopsis of this film would include various types of golf, scenes of members stymied at the 19th hole, and the peculiar ramblings of a certain tool committee.

Prizes and entertainment of a varied sort brought to a close one of Pittsburgh's greatest years.

Congratulations are in order for Chairman Harvey Garrett and his Entertainment Committee—Bob Dinkey, Elkins Knable and Earl Penrod.

Gill Gives Up-to-the-Minute Talk on High Speed Steel

North West Chapter—J. P. Gill, metallurgist for the Vanadium-Alloys Steel Co. and trustee American Society for Metals, presented his very interesting and up-to-the-minute talk on "High Speed Steel" to the Chapter at the monthly meeting on Nov. 9.

He discussed the history of high speed steel as well as the specific effect of each of the individual alloys. There was also a discussion of the structures in the annealed, hardened and tempered conditions and of how the segregate may influence physical properties.

Ample time was devoted to all of the new types of high speed steel, including the high vanadium and molybdenum types.

Red hardness, strength, toughness, resistance to wear, hardenability and cost were compared for the many types.

How furnace atmospheres during hardening may affect the structure and surface of the steel was also explained.

Philadelphia Lecture Series Concluded, to be Reprinted

The final lecture in the series on "Metals, How They Behave in Service," which was scheduled to be published in this issue of THE REVIEW, was presented by Norman Mochel of Westinghouse Electric & Mfg. Co. Since it was mainly a review of the previous lectures, it will not be published and the series is now concluded.

The thanks of the Board of Trustees and the members of the Society are extended to the Philadelphia Chapter and the authors for making this material available to the entire membership.

These lectures are to be reprinted in pamphlet form and notice of their publication will appear in a later issue of THE REVIEW.

York Has Extension Course

An extension course in metallurgy has recently been organized by the York Chapter in Harrisburg, Pa. This course, which will be held two nights a week for 30 weeks, was organized by H. M. Northrup, director of the Mineral Industries Extension Division, Pennsylvania State College, and will be similar in nature to the extension courses given by that school.

D. M. Horner, control supervisor of production, Harrisburg Steel Corp., and chairman of the Program Committee of the York Chapter, is conducting the lectures.

Development of Inexpensive Base Metal Has Placed Industrial Pyrometry on Practical Basis

Particular Consideration Given to Application of Thermo-Electric Circuit in Temperature Measurement by Ontario Speaker

By J. W. McBean

Ontario Chapter—The December meeting was held in Hamilton, the guest speaker being Perry A. Borden of the Bristol Co., who discussed the subject of "Control of Temperatures in Industrial Furnaces."

Particular consideration was given to the application of the thermo-electric circuit in temperature measurement, including the adaptation of the d'Arsonval galvanometer, both as an indicating and a recording instrument, and, in association with a potentiometer circuit, for measurement by a balance or "null" method.

It was pointed out that the use of rare metals in thermocouples is restricted by cost and by the low thermoelectromotive force developed. The development of satisfactory couples of inexpensive base metals having relatively high thermal emf's in proportion to temperatures to be measured has placed the art of industrial pyrometry on a practical basis.

Cold-End Compensator

Since the potential difference set up in a thermo-electric circuit is proportional to the difference of temperatures of the junctions, it becomes necessary either to fix the temperature of one junction as a reference value, or else to provide compensation for such changes as might take place in the temperature of this "cold" junction. American practice favors the latter procedure; and the "cold-end compensator" which, by means of a bimetallic spiral, automatically adjusts the zero of the millivoltmeter with variations of room temperature, makes it possible to perform direct measurement of temperature, even at a great distance from the furnace.

Automatic control requires not only a device for regulating the supply of a heating agent, but a measuring instrument for commanding the response of this device in accordance with deviations of the temperature from a desired predetermined value. The regulating device may take the form of a

Waterhouse and Eisenman Speakers at Joint Meeting

By Karl L. Fettler

Mahoning Valley Chapter met Dec. 13 at the Ohio Hotel in a joint meeting with the Youngstown Section of the American Society of Mechanical Engineers. National President Waterhouse and National Secretary Eisenman were fitting speakers for this occasion.

Bill Eisenman brought a new and interesting list of stories in a lighter vein as only Bill can tell them.

Dr. Waterhouse presented an address on "Pioneers of the Iron and Steel Industry" with interesting biographical sketches and anecdotes of the lives and work of such men as Bessemer, Thomas, Sorby, Dudley, and Brassert. Bill Eisenman was pointed out as the pioneer of the American Society for Metals.

Many of the local alumni of the Massachusetts Institute of Technology attended and renewed their friendships with Dr. Waterhouse. The Mahoning Valley Chapter expects to give a special invitation to the alumni of various schools whenever their faculty is represented by a guest speaker.

fuel valve or a rheostat, according to the nature of the furnace; and it may be operated either by an electric or a pneumatic motor, the latter being the more common in metallurgical work.

Mercury Switches Have Wide Use

In earlier forms of control instruments the switching mechanism was very delicate, requiring auxiliary electrical relays for operating the valve motors, but in recent forms mercury switches having capacities as high as 30 amperes can be used. Apparatus of this nature is applicable to a wide range of uses, from the smallest muffle furnaces to the control of hot-blast temperatures.

In some applications the "on-and-off" type of control, in which a valve or contactor is abruptly thrown from full on to all off, is quite satisfactory; but in many classes of work there is required a more refined control of the "throttling" or "floating" type, in which a valve or rheostat may take up any one of a large number of positions within its range, always tending toward a balance of heat flow against demand.

Available precision of control is dependent to a great extent upon furnace characteristics, but with conditions at all favorable, and under a steady state of operation, it is generally practicable to maintain temperatures within 3 or 4° F., if the furnace and the controller are properly coordinated.

Self-Balancing Recorders

The development of the null method of measurement into a recording potentiometer and its application to pyrometry were discussed, and a number of self-balancing recorders described, pointing out the advantages gained in precision and accuracy of measurement when this method is used, as well as its independence of conditions in the connecting circuit.

Where the slight time delay characterizing mechanically balanced instruments may become objectionable, use is made of an amplifying potentiometric system utilizing photocells and thermionic tubes, so that variations in a measured emf are immediately reflected as proportional changes in current in a powerful direct marking recorder. This instrument may be operated from a photocell, a thermocouple, or an optical pyrometer, and its performance is so nearly instantaneous as to render it entirely applicable to the recording of temperatures of individual billets of metal passing on conveyor rolls.

Fischbeck at Schenectady

By Constance B. Brodie

Schenectady Chapter—The December meeting was held at the Van Curler Hotel on the 14th. There were 20 members present for dinner and approximately 35 for the meeting.

H. J. Fischbeck, chief metallurgist, Pratt & Whitney Aircraft Division of United Aircraft Corp., was the speaker. His subject was "The Metallurgy of Aircraft" and covered the development of aircraft motors, their tests and inspection. The talk was illustrated by a series of excellent lantern slides.

The amount of discussion following the talk showed the members' interest in the subject.

Rail-Boat Tour Will Take Members to Coast for Congress

Four-Week Trip Planned by the A.S.M.E. Includes Sight-Seeing

Members of the American Society for Metals who plan to attend the Western Metal Congress and Exposition in Los Angeles the week of March 21 have been invited to participate in the conducted tour to Los Angeles being sponsored by the American Society of Mechanical Engineers.

This all-expense, four-week tour will provide for the trip out by rail and return by boat, including all transportation, meals (except during the Convention), hotel accommodations, and sightseeing en route for \$300 to \$350.

The tour will start March 16 in Chicago, stops will be made in New Mexico and Grand Canyon, and the group will arrive in Los Angeles Monday morning, March 21, for the Metal Congress. The group will sail the following Sunday, March 27, on the Panama Pacific Line S.S. *Virginia* for a two-week boat trip to New York including stops at Mexico, Panama and Havana.

The price includes the trip on any main-line railroad between New York and St. Louis and Chicago where the group will be assembled, going on to join others at Kansas City. The return trip is based on tourist-cabin fares from Los Angeles to New York, plus railroad fare from New York to point of departure.

Full information concerning rates and itinerary may be secured from the secretary of the American Society of Mechanical Engineers, 29 West 39th St., New York City.

Archer Discusses New Test for Steel Hardenability

By M. A. Scheil

Milwaukee Chapter—On Oct. 28 the Chapter was entertained by Frank Scherschel, in charge of color photography for the Milwaukee *Journal*.

Mr. Scherschel projected a great variety of colored transparencies to the delight of the audience, and told many interesting stories about them. The color photographs were all taken with miniature cameras on Kodachrome film.

Robert S. Archer, chief metallurgist, Chicago District, Republic Steel Corp., gave the technical talk for the meeting.

Mr. Archer discussed a new test for the hardenability of steel. In this test the steel is forged down from the billet to a bar $1\frac{1}{2}$ in. in diameter and then machined to 1 ± 0.003 in. The machined surface is finished with emery cloth.

Four inches of the bar is heated to the quenching temperature in an electric furnace with air atmosphere in a standard time of 40 min. The heated bar is quenched by hand tongs in a tank of water at 70° F. After cutting the bar in half with an abrasive disk one-

G.E. Engineer Dies



John A. Capp

JOHN A. CAPP, engineer of materials in the General Electric Works Laboratory at Schenectady, died Jan. 6 after a short illness.

He would have been 68 years of age on Jan. 14 and was a veteran of more than 45 years' service with G.E., where he specialized in the study of many types of materials entering into the construction of electric equipment.

He was a charter member of the American Society for Testing Materials, was president in 1918 and 1919, and last year was elected an honorary life member of the organization. He was also a member of the American Foundrymen's Association, and for many years was active in the American Society for Metals.

* * *

CHARLES N. ROLLER, superintendent of the tool division, Camera Works, Eastman Kodak Co., and active member of the Rochester Chapter, died Dec. 23.

* * *

WILLIAM E. RUDER, JR., 25, son of W. E. Ruder of General Electric research staff, died Dec. 4 following an operation. A graduate of Pennsylvania State College, he was employed in the research laboratories of Allegheny Steel Co. and was a member of the Pittsburgh Chapter.

half is used for Rockwell C hardness readings.

The essential readings are the S or surface hardness, the C or center hardness, and A or the area under the hardness curve. The area is expressed as Rockwell inches and is readily obtained without plotting the hardness penetration curve.

Mr. Archer pointed out several advantages of using a standard test:

1. There is need for a standardized test to make the greatest use of available information.

2. Fine-grained steels may be substituted for coarse-grained steels of the same SAC rating.

3. Variation in the standard elements, C, Mn, P, S, Cu, Cr, etc., may be studied. The test as described is adapted for rating medium carbon water quenching steels.

4. Tests of this kind enable the metallurgist to predict heat treating performance.

\$2 Binds Your TRANSACTIONS

Members who wish to preserve Vol. XXV of *TRANSACTIONS* in bound form should send their copies to National Headquarters together with \$2 which covers the cost of binding in blue cloth to match previous bound volumes.

If any member wants to keep his copies of the issues of Vol. XXV, 1937, in loose form and yet have a bound volume for his library, a complete bound volume will be supplied for \$5, postpaid.

CHAPTER CALENDAR

FEBRUARY

CHAPTER	DATE	PLACE	SPEAKER	SUBJECT
Baltimore	Feb. 7	Engineers Club	J. S. Vanick	Gray Cast Iron
Boston	Feb. 4	Mass. Inst. of Tech. Room 1-390	Edgar C. Bain	Anomalies in Heat Treatment of Steel
Buffalo	Feb. 10	Hotel Buffalo	M. F. Judkins	Sintered Carbides
Calumet	Feb. 8	Woodmar Country Club, Hammond, Ind.	R. J. Greenly	Human Problems of Technology
Canton-Mass.	Feb. 10	Medinah Club	V. N. Krivobok	Annual Midwinter Party
Chicago	Feb. 10	Alms Hotel	G. B. Waterhouse	Stainless Steel
Cincinnati	Feb. 7	Cleveland Club	A. L. Boegehold	Recent Metallurgical Developments
Cleveland	Feb. 8	Alms Hotel	G. B. Waterhouse	Modern Cast Iron
Columbus	Feb. 9	Engineers Club	G. B. Waterhouse	Recent Metallurgical Developments
Detroit	Feb. 14	Hotel	T. Smith Taylor	Plastics
Golden Gate	Feb. 21	Athens Club, Oakland	R. F. Harrington	Non-Ferrous Meeting
Hartford	Feb. 8	Hartford Gas Co.	R. F. Harrington	Cast Iron in the Light of Modern Research
Indianapolis	Feb. 21	Hoosier Athletic Club	F. G. Tatnall	Testing Materials
Lehigh Valley	Feb. 25	.....	J. T. MacKenzie	Cast Iron
Los Angeles	Feb. 10	.....	.....	.....
Mahoning Valley	Feb. 16	Ohio Edison Auditorium	G. E. Doan	Welding
Milwaukee	Feb. 7	Milwaukee Athletic Club	H. K. Ihrlig	Ihrizing
Montreal	Feb. 17	York Room, Windsor Hotel	G. W. Clark	Refining of Copper
New Haven	Feb. 17	Elton Hotel, Waterbury, Conn.	T. C. Merriman	Nickel Silver
New Jersey	Feb. 14	Essex House, Newark	J. R. Freeman, Jr.	Non-Ferrous Alloys
New York	Feb. 14	Building Trades Employers Association Club	G. W. Elmen	Magnetic Alloys
North West	Feb. 8	Alms Hotel, University of Minnesota	R. G. Guthrie	Carburizing
Notre Dame	Feb. 9	Engineering Auditorium, University of Notre Dame	F. N. Speller	Corrosion of Metals
Ontario	Feb. 4	Hamilton	R. L. Kenyon	Testing Sheet for Deep Drawing
Oregon	Feb. 11	Lloyds Club House	A. G. Zima	Nickel Alloy Steels
Philadelphia	Feb. 25	Manufacturers and Bankers Club	Albert Sauveur	Some Things We Do Not Know About Steel
Pittsburgh	Feb. 10	Roosevelt Hotel	E. E. Thum	Cost of Metallurgical Control
Puget Sound	Feb. 9	Engineers Club	B. R. Whately	.....
Rochester	Feb. 14	University of Rochester	R. L. Kenyon	Working and Drawing Qualities of Sheet Steel
Saginaw Valley	Feb. 22	Fisher Hotel, Frankenmuth, Mich.	F. P. Zimmerli	Metallurgy of Springs
Springfield	Feb.	.....	W. Finkl	Forgings and Forging Dies
St. Louis	Feb.	.....	.....	Machinability Symposium
Syracuse	Feb. 15	Hotel Onesto	Samuel Epstein	Grain Size
Texas	Feb. 3	.....	M. A. Grossmann	Heat Treatment
Tri-City	Feb. 8	Rock Island Arsenal Auditorium	H. L. Daasch	Machinability
Tri-City	Feb. 28	Garden House, Dodge Hotel	J. A. Welger & Mark Harris	Resistance Welding
Washington	Feb. 14	Sanford Riley Hall, Worcester Polytechnic Institute	H. J. French	Development in Alloy Steels
Worcester	Feb. 3	.....	.....	.....
York	Feb. 16	Gettysburg	R. R. Tatnall	Fatigue of Helical Springs
			C. H. Parker	Pyrometry

MARCH

Baltimore	Mar. 7	Engineers Club	G. D. Welty	Aeronautic Materials
Boston	Mar. 4	Mass. Inst. of Tech. Room 1-390	A. D. Bach	Commercial Heat Treatment of Steel
Buffalo	Mar. 8	Hotel Buffalo	.....	X-ray Testing
Calumet	Mar. 8	Woodmar Country Club, Hammond, Ind.	A. M. Steever	Manufacture of Steel Forgings
Canton-Mass.	Mar. 17	Hotel Onesto	V. N. Krivobok	Stainless Steels
Chicago	Mar. 10	Medinah Club	A. B. Kinzel	Effects of Alloying Additions in Steel Making
Cincinnati	Mar. 10	Alms Hotel	D. P. Forbes	Developments in Cast Iron
Cleveland	Mar. 7	Cleveland Club	H. C. Richardson	Historical Steel Making
Columbus	Mar. 8	.....	D. P. Forbes	Developments in Cast Iron
Dayton	Mar. 9	Engineers Club	D. P. Forbes	Developments in Cast Iron
Detroit	Mar. 14	.....	W. E. Benninghoff	Induction Hardening
Hartford	Mar. 8	Hartford Gas Co.	H. L. Day	Heat Treatments
Indianapolis	Mar. 21	Hoosier Athletic Club	Mr. Blackburn	Sound Film by Carnegie-Illinois Steel Corp.
Lehigh Valley	Mar. 25	Hotel Traylor, Allentown, Pa.	E. F. Davis	Gears and Carburizing
Mahoning Valley	Mar. 14	Tod Hotel	W. Boston	Machinability
Milwaukee	Mar. 14	Milwaukee Athletic Club	E. Thum	Controlled Atmospheres
New Haven	Mar. 17	Hammond Laboratory, Yale University	A. H. d'Arcambal	Factors Affecting Machinability
New Jersey	Mar. 14	Essex House, Newark	J. R. Villegas	Grain Size and Grain Growth
New York	Mar. 14	Building Trades Employers Association Club	E. R. Darby	Bearing Metal Alloys
North West	Mar. 8	Alms Hotel	J. D. Corfield	Wear Resistant Alloy Castings
Notre Dame	Mar. 9	Engineering Auditorium, University of Notre Dame	C. O. Thieme and G. P. Hallowell	Manganese Bronze
Ontario	Mar. 4	Toronto	E. Cartwright	Selection and Production of Some Cast Non-Ferrous Alloys
Oregon	Mar. 11	Lloyds Club House	G. B. Waterhouse	.....
Philadelphia	Mar. 25	Engineers Club	J. J. Crowe	Influence of Flame Upon Steel
Pittsburgh	Mar. 10	Roosevelt Hotel	E. V. Crane	Power Presses and Metal Working Operations
Puget Sound	Mar. 9	Engineers Club	G. B. Waterhouse	.....
Rochester	Mar. 14	University of Rochester	.....	.....
Saginaw Valley	Mar. 15	Hotel Bancroft, Saginaw, Mich.	W. E. Benninghoff	Induction Hardening
Springfield	Mar.	.....	Mr. Kennedy	Corrosion Resistance by Electrodeposits
Syracuse	Mar. 15	Onondaga Hotel	D. K. Crampton	Non-Ferrous Metals
Texas	Mar. 3	.....	.....	.....
Tri-City	Mar. 28	.....	G. B. Waterhouse	.....
Washington	Mar. 8	Rock Island Arsenal	A. W. F. Green	The Saga of Fine Steel
Worcester	Mar. 14	Garden House, Dodge Hotel	Sam Tour	Die Casting
York	Mar. 3	Sanford Riley Hall, Worcester Polytechnic Inst.	C. M. Loeb, Jr.	Molybdenum
	Mar. 16	York	.....	.....

Machinability Meeting Held At Watertown

Machining Problems Illustrated on Conducted Tours Through Arsenal Preceding Symposium by Boston Chapter

By L. Geerts

Boston Chapter, in a joint meeting with the Army Ordnance Association, staged a machinability symposium on December 3 at Watertown Arsenal. The technical session was preceded by a plant visitation.

Conducted tours through the various manufacturing departments began at 2:15 p.m. At several places, different machining problems were illustrated. The laboratories were open for formal inspection, with numerous displays of the metallurgical work being done at the Arsenal.

A showing of motion pictures followed; one illustrated the making, grinding and application of cemented Carboly tools and dies; the other was a film entitled "Metal Cutting Research" by the Cincinnati Milling Machine Co., reflecting the studies made of the built-up edge on cutting tools by Ernst and Mariolotti.

Col. R. W. Case, in command at the Arsenal, and A.S.M. President G. B. Waterhouse gave short talks of welcome at the evening session.

Chairman H. H. Lester presided at the symposium. The background was supplied by three well-prepared papers.

Prof. Arthur Lawrence Townsend,

Transactions Index Ready

An index to Vol. XXV of TRANSACTIONS, covering the four quarterly issues in 1937, has been prepared and is available to members of the Society at no charge on request to the National Office, 7016 Euclid Ave., Cleveland.

self-styled "Charlie McCarthy" of his M.I.T. colleagues, presented "Random Observations on Some Phases of Machinability." This covered the theoretical viewpoint.

The factors influencing machinability such as chip pressures, heat conditions, build-up, tool pressures, chatter, etc., were covered and illustrated with slides. Prof. Lessells of M.I.T. assisted with a demonstration of the Herbert Pendulum, a device for determining the maximum induced hardness as a measure of machinability.

This fine paper was followed by "Cutting Fluids a Factor in Machinability," presented by A. J. McDuff, sales engineer, D. A. Stuart Oil Co. This was a comprehensive review on the importance and complexity of cutting fluids in the realm of machinability.

Lt. Col. James Kirk, works manager, Watertown Arsenal, occupied the cleanup spot on the program. Behind the title "Shop Problems in Machinability," he discussed lucidly and candidly the struggles that arise to lick machining problems.

Production pressure demands quick results. Often the shop faces situations that have not been anticipated in laboratory studies and must work out quick solutions. The speaker illustrated his points from direct shop experience.

Time and the limits of human endurance prevented complete discussion of any of the three excellent papers. It seemed to be a generally accepted opinion among those who attended that this symposium was one of the finest meetings the A.S.M. has attempted in the Boston Chapter.

More Authors for Western Congress



B. W. Gonser



F. A. Melmoth



E. K. Smith

Partial List of Western Congress Authors Announced

(Continued from page 1)

specialized in the study of corrosion and corrosion resisting materials in the Development and Research Division of International Nickel Co. since 1927. He is a graduate of Queen's University, Kingston, Ont., Canada.

A second paper on this session, on "Tin Plate in the Canning Industry," will be presented by Bruce W. Gonser, supervising metallurgist, Battelle Memorial Institute, Columbus, Ohio. It will cover a brief description of the rolling of steel to sheet or strip, the tinning operation and manufacture of tin cans. Recent developments in tin plate will be stressed.

Dr. Gonser is the author of a book published by the International Tin Research and Development Council which is the only complete description of modern tin plate and tin can manufacture available.

Foundry Session Papers

F. A. Melmoth, vice-president, Detroit Steel Castings Co., Detroit, will discuss improvements in steel castings by moderate alloying and heat treatment during the Foundry Session of the Western Metal Congress.

Mr. Melmoth has conducted exhaustive tests of a series of sand-cast steels, both of the plain carbon and low alloy varieties, which show the versatility in physical properties available to steel castings users and the response of sand-cast steels to a considerable range of heat treatments.

On this same Foundry Session, E.

Milwaukee Told Earth Is Flat; Krivobok on Stainless

By M. A. Scheil

Milwaukee Chapter had the pleasure of hearing Major Roger Sherman Hoar, officer of the Ordnance Department, U. S. Army, on November 23. Major Hoar gave a talk entitled "The Earth is Flat."

Besides being a ballistics expert, Major Hoar holds an LL.D. and gave a very convincing argument for his theory. Most of the members were surprised to learn that in computing range angles for artillery guns no correction is made for curvature of the earth.

Dr. Vsevolod N. Krivobok, associate director of research, Allegheny Steel Co., presented the Chapter with a splendid technical talk on "Stainless Steel." This lecture has already been reported at length in this paper.

Dr. Krivobok is to be congratulated on his splendid presentation of this subject, and the large audience left the meeting with a better knowledge of stainless steels.

Stotz Dissects Various Types Of High Speed

Reviews Economic Variability and Classes Steel According to Popularity

By M. J. Donachie

Springfield Chapter held its first out-of-town meeting for the year at Greenfield, Mass., on Nov. 15, with a dinner and meeting at the Hotel Weldon.

"The Properties and Possibilities of Modern High Speed Steel" was the topic chosen by the speaker, Norman I. Stotz, metallurgical engineer, Universal-Cyclops Steel Co., Titusville, Pa.

The division of the various steels into groups and a review of the economic variability of each type in the past year was the opening chapter of the evening's talk.

Following this, the geographic distribution and availability of the various raw materials, and the effect on the aforementioned economic structure were traced very clearly by Mr. Stotz.

The various groups were dissected by the lecturer piece by piece and he showed many and varied reasons for the wide range of uses in some grades, and by the same process showed that certain other analyses were confined to a narrow range of applicability. These were subsequently classed as the popular and not so popular steels.

Effect of Alloys Shown

His discourse on the properties conferred by the various elements on the steels and the relative changes imposed by them on the heat treatment and their resultant effect was thorough and sharply descriptive. In this phase of the evening's talk, one could gather readily why the appellations "popular" and "not-so-popular" were chosen.

It was also pointed out that alloy content is not always the major factor and many other considerations command attention.

In conclusion, the speaker discussed equipment for heat treating and the merits of the various kinds at present available, salt baths, furnaces, both gas and electric, the effect of temperature and atmosphere combinations on the surface condition and metallurgical properties of the treated parts.

Use of Metallurgical Literature First Step In Research Work

By George E. Stoll

Notre Dame Chapter—Richard Rimbach, managing editor of *Instruments*, addressed a group of 100 on "The Selection and Use of Metallurgical Literature" at the regular monthly meeting on Dec. 8.

Mr. Rimbach stated that to progress the engineer must keep abreast of the new developments in his field. Hand in hand with an improved technical knowledge must go the ability to get along with and influence associates.

When complex problems arise, it matters little if the solution is the direct result of the engineers' research or whether it results from information acquired by reviewing the literature published on the subject. The main point is the solution of the problem.

The first step in the solution of any metallurgical problem involving research is to review the literature. Mr. Rimbach did not follow through the method of reviewing the literature but referred to his booklet on "How to Find Metallurgical Information" and offered to answer any question the audience might have.

More important to the young engineer is the ability to get along with associates. Only a small percentage of the graduates go directly into research. The majority secure jobs where technical knowledge is a splendid asset but the main requirement is a knowledge of human nature.

After the meeting, Mr. Rimbach was the center of a lively discussion on the problems confronting the young engineer.

The talk was preceded by an instructive movie, released by the Bureau of Mines, on oxy-acetylene welding. Phantom views showed the action of the reducing valve and the torch.

Shop Visited as Feature Of Heat Treating Lecture

By David R. Howerton

Chicago Chapter held the second of its educational lectures on Nov. 4. J. L. Burns, metallurgist, Chicago District, Republic Steel Corp., addressed the group on "Alloying Elements in Steel."

Particular emphasis was given to the effects of alloying elements on the hardenability of steels.

The third educational lecture was held Nov. 18, when Louis J. Haga, associate professor of metallurgy, Lewis Institute, presented a discussion on "The Fundamentals of Heat Treatment of Steel."

Following the lecture a tour was conducted through the Lindberg Steel Treating Co.

The entire shop was open for inspection and the latest developments in heat treating equipment and practices were observed. Gas carburizing methods, special controlled atmosphere furnaces, heating and quenching tanks, and new methods of surface cleaning were inspected by the crowd of 300.

Free Literature — Mail Coupon Below

Split Second Control

Westinghouse Electric & Mfg. Co. offers ten ways to increase profits with Ignitron split-second welding controls in an informative and attractively made up bulletin. Results are demonstrated and various models of the control described. Bulletin Ab-134.

Pearlitic Malleable

Written with the idea of giving the designing engineer and purchasing agent the concrete facts about the new pearlitic malleable irons, a folder by Belle City Malleable Iron Co. gives the qualities and precise physical properties of a pearlitic iron made by them. Bulletin R-170.

Copper Bulletin

A clearing house for news of developments in brass, bronze and copper, the "Copper Alloy Bulletin," issued by the Bridgeport Brass Co., is edited for the technical and engineering audience. Bulletin Da-163.

Hydrogen Brazing

A new "Electroblast" hydrogen brazing furnace designed for the inexpensive, clean brazing of carbide-tipped tools is described in a folder by Stark Tool Co. A full description of the method of brazing and precautions necessary is included. Bulletin Ab-186.

High Pressure Meter

Special flow meters for high pressure measurements are described in a bulletin by the Foxboro Co. A sectional view of one of these meters indicates six features which go to make this a rugged instrument for high pressure use. Bulletin Ab-21.

Certified Steels

Ryerson certified steels are the result of many years spent developing new specifications, new methods of control and complete readjustment of stocks. An interesting book by Joseph T. Ryerson & Son, Inc. tells the complete story. Bulletin Ab-106.

Machining Castings

A discourse that is brief, practical and helpful is presented by Michigan Steel Casting Co. on the subject of machining stainless and heat resisting alloy castings. General instructions precede sections on tool design, drilling, tapping, and grinding. Bulletin Ab-84.

Tractor Parts

Hardening, drawing and annealing furnaces for heat treating parts for agricultural and road machinery, particularly those which receive severe wear and shock, are illustrated and operating data for specific installations given in a folder by Surface Combustion Corp. Bulletin Ab-51.

Non-Ferrous Hardening

Leeds & Northrup Co. has a folder giving the highlights of the hardening of small non-ferrous clips in a modern Homo tempering furnace. The account of this rather unusual hardening operation is followed by a description of the furnace. Bulletin Ab-46.

Welded Design

"How to Change Over to Welded Design for Profits" is the title of a 32-page profusely illustrated bulletin by Lincoln Electric Co., which is intended as an aid in applying electric welding to the design of machines and machinery structures. Bulletin Ab-10.

Pulp Industry

A technical article by A. G. Zima of International Nickel Co., Inc., describes means for reducing the frequency of replacing damaged equipment and the costly delays in the production schedule sometimes required for such replacements. Bulletin Ab-45.

Lubricant Economy

Extreme pressure treated, high film strength lubricants, known as Houghton's Sta-Put series, grouped and graded according to industrial machinery applications, are described in a well-illustrated booklet entitled "Less Oil—Less Oftent." Bulletin Ab-38.

Tool Steel Selector

A wall chart, 30 x 20 in., to be used as a means for selecting the proper type of tool steel is offered by Carpenter Steel Co. to tool steel users in the U.S.A. only. Bulletin Jz-12.

The Review

7016 Euclid Ave., Cleveland

Please have sent to me without charge or obligation the following literature. Circle the numbers that interest you. It is important to write in your company or business connection when you return this coupon. (Please print.)

Name Title

Company

Company Address

Col. 1

Col. 2

Col. 3

Col. 4

Ab-134 Ab-51

La-132 Ja-24

Dy-135 Ay-30

La-93 Oy-111

R-170 Ab-46

Da-47 Jy-11

Na-111 S-33

La-44 Ka-103

Da-163 Ab-10

Ka-26 Aa-126

Na-118 Ea-167

La-3 De-4

Ab-186 Ab-10

Ea-79 Fx-32

Na-71 Oy-25

La-41 Fx-57

Ab-21 Ab-45

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Ea-139 Fx-66

Na-70 La-27

Ca-64 Da-165

Ab-134 Jz-12

Ea-139 Fx-66

Na-70 La-27

Ja-27 Jy-125

Ab-134 Jz-12

Ea-139 Fx-66

Na-70 La-27

La-169 Ny-48

Ab-134 Jz-12

Ea-139 Fx-66

Na-70 La-27

La-180

Drop Stamping

A brand new forming machine known as the "Cecostamp" is being placed in production by Chambersburg Engineering Co., which successfully copes with the latest advances in sheet metal working technique. Details in Bulletin La-132.

Toolmakers' Microscope

Only recently have optical methods of measuring and testing been introduced in the workshop. These methods—particularly adapted to measuring small and intricate parts—and the equipment used are fully described in a booklet by E. Leitz, Inc. Bulletin Da-47.

Conveyor Rolls

The record made by Calite alloy furnace conveyor rolls in a large steel mill having unusually heavy heart loading is told in a leaflet by the Calorizing Co. Bulletin Ka-26.

Rails

"Brunozing" is a new method of producing an improved steel rail for today's heavier and faster trains. A nicely printed and well illustrated 24-page booklet by United States Steel Corp. explains the process thoroughly. Bulletin Ea-79.

Blast Cleaning

So many changes have taken place in blast cleaning and dust collecting equipment in the past three years that Pangborn Corporation's "quick reference" catalog of condensed information will be invaluable to all those interested in this subject. Bulletin Jy-68.

Sheet Metal

One of the most modern of the current pieces of industrial literature dealing with sheet metal is Republic Steel Corp.'s "The Path to Sheet Metal Permanence," a 20-page booklet of useful information containing more than 60 interesting photographs. Bulletin Ea-8.

Refractory Blocks

Light-weight, low heat storage insulating refractory blocks known as "Insublox" for reducing heat storage and radiation losses at operating temperatures up to 2300° F. are described in a folder by Quigley Co. Bulletin Ea-139.

Electric Heat

The certainty of results obtained with electric heat is economically available in automatically controlled electric furnaces. Hoskins Mfg. Co. has a catalog stressing the advantages and low-cost maintenance of their line of furnaces. Bulletin Ja-24.

Carburizing Retorts

Low cost, flexibility, uniformity, control, quality, and less labor with retort gas carburizing says American Gas Furnace Co. Rotary, vertical and bell type retorts are described in Bulletin Jy-11.

Silver Solder

Characteristics and uses of 12 standard compositions of silver solders meeting almost all requirements for this useful material are described in a folder by Handy & Harman, Inc. Bulletin Ea-126.

Ni-Cr Castings

Compositions, properties, and uses of the high nickel-chromium castings made by The Electro Alloys Co. for heat, corrosion and abrasion resistance are concisely stated in a handy illustrated booklet. Bulletin Fx-32.

Heat Resisting Alloys

Authoritative information on alloy castings, especially the chromium-nickel and straight chromium alloys manufactured by General Alloys Co. to resist corrosion and high temperatures, is contained in Bulletin D-17.

Tempering Furnace

Technical details and operating data on Lindberg Steel Treating Co.'s new Cyclone electric tempering furnace, which has shown a remarkable performance record in steel treating operations, are given in Bulletin Fx-66.

Conveyor Furnaces

Continuous chain belt conveyor furnaces handle miscellaneous parts without pans or trays—they are efficient, uniform, and flexible in operation. Improved furnaces of this type are described by Electric Furnace Co. Bulletin Na-70.

Scleroscopes

Shore Instrument & Mfg. Co. describes its Model D standard recording scleroscope in a recent bulletin which explains the theory and practice of hardness testing with this machine. Bulletin S-33.

Galvanizing

An informative, historical, simple digest of galvanizing forms a guide to longer life for iron and steel products. This handsome, handy, 24-page book beautifully printed in color is distributed by American Hot Dip Galvanizers Association, Inc. Bulletin Ea-167.

Globar Elements

Globar electrical heating units and a variety of accessories for their operation have been catalogued by Globar Division of Carborundum Co. Bulletin Oy-25.

Newer Tool Steels

Vulcan Crucible Steel Co. has a complete and attractive catalog listing their full line of tool steels including many special types to meet the modern trends in industry. Bulletin Jy-127.

Binocular Mike

Extremely wide field, long working distance, and stereoscopic vision are only a few of the advantages cited by Bausch & Lomb for the improved KW wide field binocular microscope. Price list and description of accessories are included. Bulletin La-35.

Ingot Production

"The Ingot Phase of Steel Production" is the title of a book defining the principles of quality ingot production followed by many well-known steel manufacturers. Gathmann Engineering Co. Bulletin Ka-13.

Vanadium Castings

A new 24-page bulletin well illustrated with more than 20 photographs contains a complete description of the properties and applications of a number of vanadium alloy steels for castings where high strength is required without excessive weight or high cost. Vanadium Corp. of America. Bulletin La-27.

Laboratory Service

A new edition of "The Metal Analyst" tells about an organization established by Adolph J. Buchler specializing in the installation of metallurgical laboratories. The complete line of laboratory equipment marketed by Buchler is also catalogued. Bulletin Dy-135.

Park-Kase

A leaflet by Park Chemical Co. contains complete information concerning a new liquid carburizer of rapid and uniform penetration. Unique features and advantages of the bath are backed up with technical data. Bulletin Na-141.

Oil at Its Best

A booklet of generally useful information to metal working concerns using soluble cutting oil is offered by D. A. Stuart Oil Co., Ltd. The data should be of value in increasing soluble oil efficiency and consequent plant economy. Bulletin Na-118.

High Temperature

Designers of high temperature installations who use seamless tubing will be interested in the new Digest of Steels for High Temperature Service just published by the Timken Steel and Tube Division of the Timken Roller Bearing Co. Bulletin Na-71.

Machining Aluminum

Cutting speeds, feeds, lubricants and tool materials for machining aluminum are discussed in two divisions—for general machine shop practice and for screw machine practice—in Aluminum Co. of America's comprehensive booklet. Bulletin Na-54.

Pyrotrol

A safety device for gas-fired ovens and furnaces has been developed by the Bristol Co. for automatically lighting gas-fired industrial heaters and for protection against explosions as a result of pilot light failure. Known as the Pyrotrol, it is described in Bulletin La-87.

Thermit Welding

Of interest to all who are concerned with welding, but of particular interest to students, is a pamphlet of carefully explained and illustrated laboratory experiments in Thermit welding published by Metal & Thermite Corp. Bulletin Ca-64.

Defi Rust

Analysis and descriptive notes of nine types of heat and corrosion resisting steels made by Rustless Iron and Steel Co. are contained in a handsome folder. Bulletin Ha-169.

Stainless Data Book

All users of stainless and heat resisting alloys should find invaluable the information contained in a booklet published by Maurath, Inc., giving complete analyses of the alloys produced by the different manufacturers, along with the proper electrodes for welding each of them. Bulletin Jy-125.

Cleaning Processes

An attractive 12-page booklet entitled "Scientific Metal Cleaning" has been published by Detroit Rex Products Co. It describes in detail the applications and advantages of Detrex degreasers with Perm-A-Clor or Triad Safety Solvents and the applications of Triad Alkali Cleaning Compounds and Strippers. Bulletin Oy-III.

Mo-W High Speed

J. V. Emmons, metallurgist for Cleveland Twist Drill Co. and largely responsible for the development of the molybdenum-tungsten high speed steels known as Mo-Max, has prepared a general description of these new steels. Bulletin Ka-103.

Molybdenum

Climax Molybdenum Co. presents their annual book giving new developments in molybdenum, particularly as an alloy with iron and steel. The engineering data presented are made clear by many tables and illustrations. Bulletin Dc-4.

Recuperators

Results obtained with Carborundum Company's recuperators using Carbofrax tubes are fuel savings, closer temperature control, faster heating, and improved furnace atmosphere. Complete engineering data are given in Bulletin Fx-57.

Furnace Parts

A valuable feature of Driver-Harris Co.'s folder on Nichrome cast furnace parts is a table giving the tensile strength of Nichrome castings at various temperatures. Bulletin Da-19.

Tempering

Vertical batch type tempering furnaces are described in a folder by Industrial Heating Equipment Co. Capacity and production figures and a diagram of the furnace are included along with a complete description. Bulletin Ia-168.

Meehanite

A compact but complete specification chart gives the recommended grades of Meehanite metal for various service requirements. Complete physical properties and applications are included. Bulletin Da-165.

Electric Salt Baths

Literature is available from Bellis Heat Treating Co. describing electrically heated bath furnaces which are economical to operate and have a wide range of applications in hardening, annealing and heat treatment of high speed steel, stainless steel, nickel, aluminum, copper and bronze, etc. Bulletin Ny-48.

Electronic Control

Exactly how the electronic principle is used to insure exact automatic control of furnace temperature is told and full data given on the "Aldor" pyrometer controller made by Illinois Testing Laboratories, Inc. Bulletin La-180.



The Junior Members' Own Page



Why Do Metals Corrode?

[The first prize of \$5.00 for the best and most understandable answer to this question was awarded to Edward J. Pavesic of Chicago. Second prize of \$3.00 went to William J. Schwarz of Cincinnati, and third prize of \$2.00 to Charles Quinton Smith of Chambersburg, Pa. Mr. Pavesic's essay follows.—Ed.]

Corrosion describes a chemical process that goes on quietly day and night eating up a considerable part of the metals that men have dug, refined and wrought. Its most readily apparent effects are those on iron and steel (we call the corroded iron "rust"), but it damages most other metals as well.

When a metal corrodes it is merely returning to a state similar to that in which it was first found. There is very little difference chemically between iron rust and iron ore. Both are essentially compounds of iron with oxygen. The same similarity between ores and corrosion products is found among other metals, although the non-metallic elements combined with the metal need not be oxygen. But no matter what they may be, their reaction with the metal is called an oxidation because it is fundamentally similar to the reaction between a metal and oxygen. The reverse change, in which a metal is released from the combining elements and returned to the metallic state, is called reduction.

Remember that the conversion of an ore to a metal is a reduction, and the corrosion of the metal is an oxidation. These changes are regarded as electrical. When an atom is oxidized it loses electrons (negative electricity) and becomes more positively charged. Conversely an atom becomes more negative when reduced.

In general, acids are far more corrosive to metals than is oxygen. All acids contain positively charged hydrogen, and when they react with metals this charge is transferred to a metallic atom and free gaseous hydrogen is released. In short, an atom of the metal displaces hydrogen from the acid, forming a salt.

The metals themselves show widely different tendencies to corrode. A rough index of these differences is shown in the accompanying table, in which the metals are approximately in the order of increasing resistance to corrosion.

1. Sodium	8. Lead
2. Magnesium	9. Tin
3. Aluminum	10. Hydrogen
4. Zinc	11. Copper & brass
5. Chromium	12. Silver
6. Iron & steel	13. Gold
7. Nickel	

For example, sodium reacts with water with almost explosive violence. Magnesium is readily eaten away by

(Continued on page 8)

Bearing Metals Explained

By Max Bolotsky

Missouri School of Mines Group—The metallurgy of lead and tin-base bearing metals was explained to the M.S.M. Chapter on Dec. 3 by D. J. Doan, alumnus, and research metallurgist with the Eagle-Picher Lead Co.

Although his talk was entitled "Bearing Metals," Dr. Doan limited his remarks to the lead-base and tin-base alloys. The prerequisites for good bearing metals of these types and the reasons for bearing failure were related in detail to a capacity gathering of future metallurgical engineers.

The Story of Steel

~ *The Open-Hearth Department*

"That was quite a sight, Al, watching them make a cast from the blast furnace. I don't suppose the open hearth will be quite so spectacular."

"It will if we catch them pouring the molten iron into the furnace. But while we're on our way over there I'd better brush you up on the details."

"That's not a bad idea. Where does



Stream of Iron Flowing From Blast Furnace Into Ladle (Photos Courtesy Carnegie-Illinois Steel Corp.)

the iron go after it flows out of the blast furnace?"

It runs into huge ladles, each one holding about 150 tons of molten iron. These ladles are mounted on wheels like a freight car and are switched by a locomotive to the open-hearth department. Here they come through the yard now."

"Sure enough—a real locomotive and a whole string of cars. What mammoth things they are! But does the iron stay melted on the way over to the open hearth?"

"Sure. The ladles hold so much iron that it doesn't have a chance to cool off, and besides they are lined with a special firebrick which prevents the escape of the heat. But here we are."

"Wow! Look at that overhead crane lift that ladle, Al—just as though it were nothing!"

"We sure are doing well on this trip. We're just in time again to see them pour the iron into the furnace."

"Al, just look how evenly and steadily it pours—as easy as it is for me to put the cream in my coffee."

"Yes, but we'd better get down to fundamentals again so we know what's really going on inside those furnaces."

"I seem to have picked up an idea somewhere along the line that the open-hearth furnaces refine the iron. Is that right?"

"Right, Bob. The iron from the blast furnaces, you probably know, is referred to as pig or cast iron, and one of the main differences between pig iron and steel is that pig iron contains

Gill Addresses Mines Men

By C. Y. Clayton

M.S.M. Group—J. P. Gill, M.S.M. '18, metallurgist, Vanadium-Alloys Steel Co., talked before 125 members and guests on the subject of "The Steel Industry" on Dec. 16.

The meeting was held in the Metallurgical Engineering Building by the Missouri School of Mines Group, A.S.M.

During the afternoon an informal meeting was held at which Mr. Gill discussed "Tool Steels."

a far greater percentage of carbon than steel does. Then there are other chemical elements that also have to be removed."

"You can bend and twist steel, can't you, Al, but if you try to bend iron, it will break and crack, won't it?"

"Well, the way we say it is that the iron lacks malleability and ductility. Steel properly made can be rolled or forged or otherwise shaped while hot, and even when cold in special instances."

"Well, tell me how to get the carbon out of the pig iron."

"By chemical reaction, Bob. But let's take a look at the furnaces."

"Are these all separate furnaces in this long line, Al?"

"Yes, those are all separate hearths and the spaces between are for the gas and air ducts."

"What are gas and air used for?"

"For fuel, Bob. They are heated in the checkers or regenerative chambers below the ducts, and when the hot gas and air enter the furnace combustion takes place and heats the metal."

"Then what happens to the burned gases after combustion?"

"They are forced above and around the molten metal and out the other side down over the checkers and out the chimney."

"Why over the checkers again?"

"The spent gas gives up its heat to the checkers and when the current is



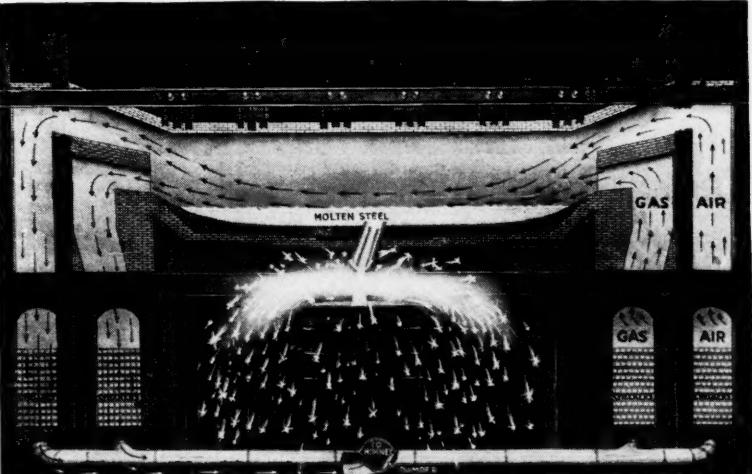
100 Tons of Molten Iron Being Poured Into Open-Hearth Furnace

reversed this heat is in turn given up to the fresh gas and air currents entering the hearth."

"Well, that's pretty clever, all right. I suppose these furnaces are a pretty good size."

"These have a capacity of about 80

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Cross-Section of Open-Hearth Furnace Showing the Current of Hot Gas and Air Being Forced Above and Around the Molten Metal and Passing Out Through the "Checkers" at the Left, Thence Out to the Chimney. The damper at bottom is then turned over to the left, and the current is reversed so that heat stored up in the checkers is imparted to the gases

Michigan Tech Has Three Meetings of A.S.M. Group in Fall

By J. Leon Gittlen

Michigan College of Mining and Technology Group—Of the three meetings held recently by the A.S.M. group at Houghton, the first one on Oct. 20 was open and informal and designed primarily to interest new students in membership in the A.S.M.

Messrs. A. Eklund and J. L. Gittlen explained to the assemblage what advantages and benefits might be derived from membership in the society.

Smokes and refreshments were provided to all present. Suggestions as to what members would desire to have incorporated in the programs of subsequent meetings were invited.

Four Members Speak

The program for the meeting on Nov. 17 consisted of four short talks given by members, each one of which was followed by a short discussion. Speakers and subjects were as follows:

T. H. Ginsburg, The Utilization of Secondary Non-ferrous Metals at the Detroit Division of Federated Metals.

E. J. Egan, Zinc-Base Die-Casting Practice.

A. Raphael, Technique Employed in Steel Casting at the Detroit Steel Casting Co.

R. Ferguson, Heat Treating Technique at the Sullivan Machinery Co.

At the meeting on December 8 the appointments for the Snow Statue Committee for the Michigan Tech Winter Carnival to be held on January 21 and 22 were announced as follows: G. Higgans, chairman, R. Thomas, T. Ginsburg, E. Egan, and R. Prout.

It is the duty of this committee to design and supervise the construction of a snow statue which will be built on the campus and represent the Michigan Tech group of the A.S.M. on this occasion.

The program consisted of a moving picture, "Making It Tough," from the U. S. Bureau of Mines library, and a talk by A. Raphael.

Mr. Raphael's talk was titled, "The Effect of Manganese and Copper Upon the Hardenability of Cast Iron." This talk was followed by a general discussion.

The Open Hearth

(Continued from page 7)

or 100 tons, I believe. The hearths are about 40 ft. long and 16 ft. wide, and the molten metal is about 24 in. deep."

"What else is in there besides the pig iron, Al?"

"Before the iron was poured into the furnace from the ladle, the furnace already contained a certain amount of steel scrap, ore and limestone."

"Were these poured from a ladle in the same way?"

"No, they were mechanically charged while cold into the hot furnace before we got here, but they were melted before the iron went in. The whole molten mass forms a slag which takes up the carbon, silicon and phosphorus which must be eliminated."

"How long does that take?"

"The refining process continues for several hours until the metal in the furnace becomes practically pure iron."

"Well, but I thought steel always had carbon in it. I wish you wouldn't contradict yourself so much, Al."

"Hold on, don't rush me, Bob. Of course steel has carbon in it. But first the iron has to be purified, and then while it's still in the open-hearth furnace, the proper amounts of carbon, manganese or other alloying elements are added back into the bath."

"Then is it steel?"

"Yes, when the refining process is complete and the proper quantities of essential materials added to the bath, the steel is finished and the heat is tapped into another big ladle."

"Does it finally solidify then?"

"Not until it's poured into ingot molds. The ladles are picked up by the overhead crane and carried to a long line of molds and the proper amount of steel is poured into each one through a small hole in the bottom of the ladle."

"How big are these ingots?"

"They vary in size depending on the purpose for which they are intended. I think we can get in to see the rail mill, and the ingots they use for rails weigh about 5 tons each. They are about 2 ft. square and 7½ ft. long."

"You mean that from a chunk of steel like that they make rails?"

"Yes, and come along. Maybe we can see it done."

(To be Continued)

Discussion Battle Provoked On Steel Mill Responsibility

By James Patterson

Los Angeles Chapter—At the November meeting Clarence W. Froome, superintendent of mechanical equipment, Union Oil Co. of California, gave a short talk on the history and development of oil well drilling equipment.

Mr. Froome stressed mainly the important part that metallurgy plays in the development of the oil industry. Still further improved steels will have to be made available if the drillers are to secure oil from greater depths.

The speaker read a report covering failures that had developed in equipment, and had been traced to coarse grain structure, faulty heat treatment, non-metallic and slag inclusions. In his opinion the solution to the problem of drill pipe failures lies with the steel mill.

At the conclusion of this talk a lively discussion was held in which the members expressed many opinions concerning the problems that the metallurgist, heat-treater, vendor and manufacturer have in developing new steels for the oil industry. Mr. Froome's contention that the steel mills should exercise greater metallurgical control and supervision brought the steel representatives present to their feet and a wordy "battle royal" of discussion ensued.

Why Do Metals Corrode?

(Continued from page 7)

boiling water. The slow rusting of iron, and the still slower formation of a green coating on copper are things everyone has observed. The corrosion of silver is limited to tarnishing, while gold is scarcely attacked at all.

Water, oxygen and carbon dioxide are the most active agents of corrosion. The most important and probably the only weapon with which to combat this greatest foe of metals is in the use of stainless steels and other highly alloyed metals.

Standard Alloy Adds Furnace

Standard Alloy Co., Inc., Collamer Road, Cleveland, has just completed the installation of another electric melting furnace capable of melting one ton per hour. This additional equipment doubles the company's previous capacity.

The new furnace operates off 11,000 volts primary. Two individual 11,000-volt lines were brought about a mile to serve it.

Kicherer Joins Tractor Works

Harry J. Kicherer, vice-chairman of the North West Chapter, A.S.M., has joined the manufacturing staff of the Tractor Works, International Harvester Co., Chicago.

Mr. Kicherer has been actively engaged in all the work of the Chapter for many years. At the last meeting he was honored with several talks of merit from Alexis Caswell, secretary, and Ralph Dowdell, past chairman.

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Positions Wanted

METALLURGIST: M.I.T. graduate 1932. Five years experience in metallurgical and inspection work. At present engaged in metallurgical control of bar steels and wire products (including springs, welding and cold heading wire). Experience in physical testing, metallography and heat treatment. Age 26. Box 1-10.

METALLURGIST: Chemical engineering graduate; three years experience as assistant metallurgist for a Midwestern foundry. Experience in routine chemical and physical analysis for iron, steel, clay, sands; thoroughly familiar with cupola practice. Box 1-15.

STUDENT METALLURGIST: Desires position in chemical or metallurgical laboratory with opportunity to study. Almost two years experience in engineering college. Will locate anywhere. Box 11-5.

METALLURGIST: B.S. in engineering; age 29. Two years experience physical testing, metallography and steel analysis. For past two years metallurgist in charge of laboratory and heat treat operations in tractor and truck parts plant. West Coast preferred but not essential. Now employed. Box 1-20.

STUDENT METALLURGIST: High school and 2½ years in a technical school; at present attending Fenn College evening course in metallurgy (third year). Two and a half years experience as machinist and heat treater. Age 25; married. Ferrous metallurgy preferred and work in steel mill desired but not essential. Box 1-25.

SALES ENGINEER in any engineering or chemical line: B.S. in metallurgy from Penn State, 1934. Experience in openhearth, rolling mills, wire mills, tube mills and laboratory; ferrous and non-ferrous metallurgy. Age 26; married. Location not important. Box 1-30.

FOUNDRY METALLURGIST: Six years foundry experience in every department from core room to pattern shop. Has worked through two years of technical college and a night school course in metallurgy. Now employed in steel company laboratory. 27 years old. Would like position in foundry or manufacturing company in Cleveland. Box 1-35.

Herty Compares Present-Day Open-Hearth Control Methods to Conditions in 1924

By A. J. Dornblatt

Washington Chapter—The technical developments in open-hearth steel which C. H. Herty, Jr. of Bethlehem Steel Co. discussed at the meeting on Oct. 11 were ably and clearly presented and served to emphasize advances in steel metallurgy that have come about in recent years.

Certain types of control that have gradually come into open-hearth steel practice were discussed. For example, there were only "home" scrap and "purchased" scrap in 1924 to worry about; today the metallurgist has imposed scrap control, and specifications restrict the amounts of certain elements as well as the size of the scrap.

Fuel and flame control have been established with the result that whereas in 1924, 500 lb. of coal was used in producing one ton of steel in the open hearth, today 350 lb. is sufficient. Metering of fuel and analysis of furnace gases, as well as flame direction, have helped to make such progress possible.

Least satisfactory control is that over refractories. Here is a problem for the future.

Chemical control covered little but phosphorus and sulphur in 1924, and these elements were determined an hour before tapping. Today as many as 20 chemical analyses and 15 carbometer tests (carbon content by magnetic analysis) on one heat are not uncommon and analyses are reported in from 15 to 20 min.

Slag control, it has been demonstrated in late years, is of fundamental importance. The FeO content and lime-silica ratio materially affect oxidation. The phosphorus content of the finished steel depends on the lime-silica ratio.

The degree of oxidation of the steel depends on the nature of the slag and it should be possible, using proper control methods, to anticipate the requirements of the heat and avoid over-oxidation.

ing conditions near the end of the heat.

Deoxidation with aluminum can be used to give the desired grain size characteristics to a steel, but it is necessary to have control of and know the degree of oxidation at the time of the aluminum addition for best results.

In the absence of oxygen, aluminum does not give a fine-grained steel; if too much oxygen is present at the time of deoxidation, a dirty steel results.

The greater hardenability of coarse-grained steel Dr. Herty explained by stating that coarse-grained steel should harden deeper in a given quenching time than fine-grained because the transformation from austenite to fine pearlite begins at the surface and the coarse grains offer less surface and there will be less of the transformation products and hence more martensite.

Thus it was shown by Dr. Herty that the properties of a steel are dependent on events that transpired in the early history of the steel as it went through the open-hearth process.

Washington Hears Palmer

By A. J. Dornblatt

Washington Chapter had the pleasure of listening to talk by Frank Palmer of the Carpenter Steel Co. last Nov. 8 on the "Manufacture and Selection of Tool Steel." This talk has been given before several other chapters of the Society, and has already been reported at length in THE REVIEW.

An interesting film was shown that depicted the manufacture and inspection of tool steels as practiced at a modern plant.

Mr. Palmer's talk was very well received and the possibility of simplifying tool steel selection no doubt comes as a boon to many struggling to find a way out of the metallurgical maze of excessively "tailor-made" tool steels.

CARBURIZING

papers and discussions of Atlantic City Carburizing Symposium

MANY men who attended the five day carburizing symposium at the National Metal Congress in Atlantic City regretted the fact that they couldn't take down all of the excellent points which were developed in the papers and discussions.

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